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A Scarabaeid new to Long Island, *Trichius texanus* Horn, collected by Mr. Engelhardt; meeting, March 15, 1910.

Thelydrias contractus difficult to kill with bisulphide of carbon; meeting, May 3, 1910.

BIOLOGICAL NOTES ON CEUTORHYNCHUS MARGINATUS PAYKULL (COL.).[1]

By S. W. Frost.

Ithaca, N. Y.

During the past season the writer found the larvæ of a small beetle feeding on the ovules and seeds of the dandelion. This insect attracted much attention, for little seemed to be known about it. Specimens were sent to C. W. Leng, who identified them as *Ceutorhynchus marginatus* Payk., a European species heretofore unknown to America. The abundance of the insect, its interesting habits, and undoubted economic importance induced the writer to make a study of its life history.

At this point the writer wishes to express his thanks to Dr. Robert Matheson who has assisted greatly in correcting and arranging this paper.

Historical.

From an examination of the European literature it appeared that very little was known of the life history and habits of this beetle. It

[1] Contribution from the Entomological Laboratory of Cornell University.

was originally described by Paykull (1792). Since that time several systematic papers dealing with this group have been published by various authors among which Gyllenhal, Schultz, Weiss, Bedel, Rye, Perris, and Edwards are the most important. Practically nothing has been published on its life history. Kawall (1867) gives a few notes on the larva of *Cœliodes punctiger* Schh. (= *Ceutorhynchus marginatus* var. *punctiger* Gyll.) occurring in the heads of dandelions. Perris (1876) verifies Kawall's observations and states further that *C. marginatus* Payk. occurs in the heads of *Hypochœris maculata,* a plant belonging to the same group as the dandelion, *Taraxacum officinale.*

DISTRIBUTION.

This species is common throughout Europe. It has been recorded from England, Germany, France, Italy, Turkey and from several places in northern Africa. In this country, as far as known, it is not widely distributed. It has been taken in New York, Massachusetts and Ohio. The writer has found the species abundant at Ithaca, Dryden and Freeville, N. Y. Other collectors have taken it at Padlesford, Syracuse, Portage, Batavia, Sonyea, Holcomb, Nunda, and West Point, N. Y.

FOOD PLANTS.

The larva of *C. marginatus* feeds on the ovules and seeds of our common dandelion *Taraxacum officinale.* Kawall (1867) mentions the same food plant. Bargagli (1883) states that he found the larvæ working on a species of *Trifolium.* He also found the variety *C. marginatus punctiger* Gyll. feeding in the heads of *Taraxacum vulgare.* Perris (1876) and Bedel (1888) give *Hypochœris maculata,* a plant belonging to the dandelion group, as a food plant. Heretofore there has been no records of the feeding habits of the adults. An observer at Syracuse, N. Y., reported that the adults were found on lettuce and were causing serious injury. The writer has seen the adults feeding on the leaves and stems of the dandelion making large scars on the stems and eating out irregular patches on the under surface of the leaves (Plate III, fig. 4). They have not been observed feeding on lettuce though close search has been made about Ithaca.

It is interesting to note that most of the North American species

of *Ceutorhynchus,* north of Mexico, which have been studied, forty-seven according to Chittenden, have been found on cruciferous plants. Blatchley and Leng (1916) state that *C. neglectus* probably feeds on *Polygonum sp.* The species of *Ceutorhynchus* occurring in Europe have been found on many plants other than the cruciferæ; Polygonum is mentioned by Blatchley and Leng, and Bargagli (1883) gives a long list of plants on which they occur.

This beetle is evidently capable of playing an important part in checking the spread of the dandelion. The writer has observed that an enormous amount of seed is destroyed by the larvæ of this beetle. When four or five larvæ are present a large percentage of the seeds are destroyed. During the egg-laying period one thousand four hundred dandelion heads were examined to determine the percentage of infestation. These were gathered from five different localities about Ithaca, N. Y., and are representative. Sixty-five per cent. of the dandelions were found to be infested. The preceding summer no counts were made but the writer is of the opinion that the infestation was even greater. The following table gives the counts made in 1916.

Number of Heads Examined.	Number of Heads Infested.	Number of Heads Free.	Percentage Infestation.
300	220	80	73%
300	158	142	52%
300	141	159	47%
300	261	39	87%
200	128	72	64%
1,400	908	492	65%

A number of counts was also made to determine the percentage of seeds eaten in a single flower head.

Number of Larvæ Present.	Total Number of Seeds.	Number of Seeds Eaten.	Percentage of Seeds Eaten.
2	198	38	24%
2	186	20	11%
4	162	84	51%
?	169	51	31%
2	166	86	51%
1	137	70	51%
?	169	63	35%
3	186	68	36%

LIFE HISTORY.

On April twenty-six the beetles were first observed coming out of their hibernating quarters. A few days later egg laying commenced. April thirtieth eggs were found abundant out of doors although pairs of beetles which were kept indoors did not commence laying until May 2. The writer had no difficulty in inducing the beetles to lay in captivity.

Copulation lasts for five or six minutes. The male grasps the female about the abdomen with his middle and hind legs. His front legs are stretched forwards and the claws are hooked over the front edge of the prothorax of the female. A few minutes after copulation the female becomes nervous and wanders over the dandelion bud and finally comes to rest at the base of the bud with her head downward. She here proceeds to bore a hole into the bud with her proboscis. At first she eats her way through the involucre, then works her beak between the ovules until she forces it down its entire length into the bud. This takes her about nineteen or twenty minutes, after which she turns about quickly and lays her eggs through the hole she has made. The number of eggs laid in a single puncture varies from one to five. From an examination of over two hundred dandelion heads two eggs were found to be the average number. It is not uncommon to find as many as three or four egg punctures in a single bud, so that a bud may contain as many as ten eggs. Infested buds are very conspicuous because of the black masses at their base formed by the milky fluid of the dandelion which oozes through the egg punctures and hardens on the outside.

The eggs are laid throughout a considerable period of time. A number of experiments were carried on to determine the oviposition period. All the beetles used in these experiments were collected before egg laying was observed out of doors. The first eggs laid in captivity were on the second of May. During May eggs were very abundant but in June egg laying was greatly reduced and in July only a few eggs were laid. Thus the oviposition period lasts a little over two months.

TABLE OF NUMBER OF EGGS LAID BY CEUTORHYNCHUS MARGINATUS PAYK.

Exp. No.	April.					May.													
	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B 19	..	×	..	..	.....	..	..	..	2	4	4	5	2	5	6	3	..	3	..	.....
B 20	..	×	..	..	♂ ♀ D.	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	.....
B 21	×	..	..	..	.....	..	..	4	3	6	2	..	2	...	1	..	..	..	..	.....
B 22	×	..	..	..	.....	..	..	..	1	♀ D.	.....	..	..	..	..	..	..	..	..	.....
B 23	×	..	..	..	.....	..	..	..	..	2	.....	3	..	1	..	..	..	2	..	.....
B 24	×	..	..	..	.....	..	2	..	..	.....	.....	..	..	..	..	..	..	..	..	♀ D.
B 25	×	..	..	..	.....	..	..	..	..	5	3	2	2	3	..	1	..	1	1	.....
B 26	×	..	..	..	.....	..	2	5	5	2	2	2	..	....	..	2	..	1	..	.....
B 27	×	..	..	..	.....	..	..	..	..	.....	.....	..	1	3	..	..	..	..	..	.....
B 28	×	..	..	..	.....	..	..	5	2	2	♂ L.R.	..	1	2	7	3	..	2	2	4
B 29	×	..	..	..	.....	..	..	..	..	♀ L.	.....	..	..	..	..	..	..	..	..	.....
B 31	..	..	..	..	.....	×	..	..	..	2	.....	3	1	C.8	5	2	2	4	3	4
B 32	..	..	..	..	.....	×	..	..	..	2	.....	3	2	2	1	1	..	3	.	2
B 45	..	..	..	..	.....	..	..	..	..	×	6	4	2	6	4	..	..	4	7	4
B 50	..	..	..	..	.....	..	..	..	..	.....	×	1	1	1	1	..	..	..	..	.....
B 64	..	..	..	..	.....	..	..	..	..	.....	.....	..	×	..	..	..	..	..	..	.....

Exp. No.	May.											June.							
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7
B 19	..	1	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 20	..	..	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 21	..	..	..	..	..	..	3	..	..	3	2	..	..	5	..	..	..	..	..	..	1	..
B 22	..	..	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 23	..	..	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 24	..	..	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 25	4	3	..	..	..	..	..	..	..	♂ ♀ L.	.....	..	..	..	..	..	..	..	..	..	..	..
B 26	..	..	..	..	3	..	2	..	..	.....	C.3	..	..	2	..	..	..	7	..	..	..	..
B 27	C.	..	..	..	..	..	..	..	..	.....	♂ D.R.	..	..	..	..	..	..	..	..	..	..	..
B 28	4	..	..	2	..	..	2	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 29	..	..	..	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 31	2	..	2	..	..	..	..	..	..	.....	.....	..	..	..	..	..	..	..	..	..	..	..
B 32	2	..	..	..	..	..	2	..	..	.....	.....	..	..	..	..	4	..	..	..	..	2	..
B 45	6	5	..	2	..	..	2	2	5	.....	4	..	..	..	2	..	5	..	..	3	..	..
B 50	..	..	..	..	..	..	..	..	..	.....	4	..	..	..	..	..	..	..	..	..	..	..
B 64	..	..	..	C.	..	..	1	..	..	.....	C.	..	..	..	..	..	..	..	..	..	..	..

Exp. No.	June.																					
	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
B 19	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 20	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 21	..	.....	..	.....	..	..	..	..	1	..	..	..	..	..	..	♂ L.R.	..	..	.....	..	..	..
B 22	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 23	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 24	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 25	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 26	..	2	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 27	4	.....	..	.....	..	..	..	..	3	..	..	..	..	2	..	.....	..	..	.....	..	..	..
B 28	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	♂ L.	..	..	..
B 29	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 31	..	.....	..	.....	..	..	..	..	C.	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 32	..	3	..	2	..	3	..	..	2	..	..	..	..	..	2	2	..	..	.....	5	..	..
B 45	..	.....	..	♀ L.	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 50	..	♀ D.	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..
B 64	..	.....	..	.....	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	.....	..	..	..

Exp. No.	June.	July.								
	30	1	2	3	4	5	6	7	8	9
B 19	.....	.....	...	.....	.....	...	♂♀D.	...	...	.....
B 20	.....	.....	...	.....	.....	...	.....	...	...	.....
B 21	2	.....	...	.....	....	...	1	...	...	.....
B 22	.....	.....	...	.....	.....	...	.....	...	...	.....
B 23	.....	.....	...	.....	.....	...	.....	...	...	.....
B 24	.....	.....	...	.....	.....	...	.....	...	...	.....
B 25	.....	.....	...	.....	.....	...	.....	...	...	.....
B 26	.....	.....	3	.....	♀D.♂L.	...	.....	...	...	.....
B 27	.....	.....	...	♂♀D.	.....	...	.....	...	...	.....
B 28	.....	.....	...	.....	.....	...	.....	...	...	.....
B 29	.....	.....	...	.....	.....	...	.....	...	...	.....
B 31	.....	♂D.	...	.....	.....	...	.....	...	...	♀D.
B 32	.....	.....	...	.....	.....	2	.....	...	...	.....
B 45	.....	.....	...	.....	.....	...	.....	...	...	.....
B 50	.....	.....	...	.....	.....	...	.....	...	...	.....
B 64	.....	.....	...	.....	.....	...	.....	...	...	.....

Exp. No.	July.									Total No. Eggs Laid.
	10	11	12	13	14	15	16	17	18	
B 19	.....	...	.....	...	...	...	.....	.....	.....	35
B 20	.....	...	.....	...	...	...	.....	.....	.....	0
B 21	♂♀D.	...	.....	...	...	...	.....	.....	.....	36
B 22	.....	...	.....	...	...	...	.....	.....	.....	1
B 23	.....	...	.....	...	...	...	.....	♂♀D.	.....	8
B 24	.....	...	.....	...	...	...	♂D.	.....	.....	2
B 25	.....	...	.....	...	...	...	.....	.....	.....	25
B 26	.....	...	.....	...	...	...	.....	.....	.....	43
B 27	.....	...	.....	...	...	...	.....	.....	.....	13
B 28	♀D.	...	.....	...	...	...	.....	.....	.....	38
B 29	.....	...	.....	...	...	...	.....	.....	.....	0
B 31	.....	...	.....	...	...	...	.....	.....	.....	38
B 32	.....	...	♂D.	...	...	...	.....	♀D.	.....	47
B 45	.....	...	.....	...	...	...	.....	.....	.....	73
B 50	.....	...	.....	...	...	...	.....	.....	.....	8
B 64	.....	...	.....	...	...	...	.....	.....	♀D.	1

× = Experiment started. C. = Copulation observed. D. = Dead. L. = Lost. R. = Replaced.

Many of the flowers are deformed by the egg punctures of the female. Punctures at the base of the bud in their normal position do not interfere with the development of the flower but frequently the female makes a puncture near the top of the bud. In this case the individual flowers of the head become distorted about the puncture and the dandelion does not develop symmetrically. There may be other reasons for deformed flowers but a puncture near the top of the bud is certain to interfere with the normal development of the flower.

The Egg.—The egg when laid is pale yellow or nearly transparent and looks like a minute drop of jelly. It is smooth, shining, and without any sculpturing. About a day before hatching the chitinized mandibles of the larva can be seen working beneath the egg shell. The shape of the egg varies somewhat. They are usually elliptical though frequently they tend towards ovoid. Length .67 mm., width .42 mm.

Larva.—The larva is perhaps the most conspicuous stage of this insect. The adults while abundant are only seen in early spring and even then they are shy and like to hide away at the base of the plant. During May and June one can pick up a dandelion bud most anywhere and be quite certain to find two or three fat grubs feeding on the seeds.

INCUBATION PERIOD OF CEUTORHYNCHUS MARGINATUS.

Exp. No.	Eggs Laid.	Eggs Hatched.	No. of Days.
B 30	April 30	May 5	5
B 35	May 2	" 5	3
B 53	" 6	" 11	5
B 63	" 8	" 13	5
B 69	" 22	" 28	6
B 3	" 24	June 1	8
B 6	" 24	" 1	8
B 7	" 24	May 30	6
B 78	June 23	June 29	6

The eggs hatch in three to eight days. Although the young larvæ take their first meal on the ovules they do not feed very much until the flowers have been fertilized and the seeds have commenced to develop. At this time the larvæ feed ravenously, seeming to be aware that they must hasten their growth before the seeds become hard and dried. They burrow into the seeds, eating out the contents and leaving nothing but the seed coats. A single larva requires from fifteen to twenty seeds for its development and when several larvæ are present nearly all the seeds of the flower head are eaten. If a dandelion head is opened at this time the presence of the larvæ is very evident for great masses of excrement and excavated seeds fill the head (Plate II, fig. 4).

The mature larva (Plate I, fig. 2) is a footless grub 5½ to 6 mm. long and 1½ mm. wide. It tapers gradually towards both ends and

is widest about one third the distance from the caudal end. The divisions of the segments are distinct on the ventral side. On the dorsal side the segment are subdivided into smaller lobes, usually two. The last abdominal segment bears a fleshy proleg. The head is rather small and moderately chitinized. The eyes are missing and the antennæ are represented by a minute protuberance near the lower end of the frontal sutures.

The mandibles are not more heavily chitinized than the head except at the tips. These have two blunt teeth and a single seta on the outer margin. The epicranial suture is distinct; the main arm extends to about the middle of the head, and the two branches extend nearly to the inner angle of the mandibles where they curve inwards. The front is rather small, and bears a pair of setæ at its cephalic margin. The epicranium is not separated from the genæ by sutures. It bears on each side four setæ, one near the main arm of the epicranial suture and about the same distance from the point where the suture divides. A second seta laterad and slightly above the first. A third laterad of the branches of the epicranial suture, very close to it and about the middle of the suture. A fourth at the lower angle of the epicranium near the end of the epicranial suture. There are two setæ on the genæ, the first is at the side of the head and about half way between the first and third seta of the epicranium. The second is lateral and below the fourth seta of the epicranium. The clypeus is distinctly set off by sutures and is about three times as broad as long. The labrum is distinct and bears a pair of large median setæ and a small seta laterad of these. The under side of the labrum is complex. There are five pairs of sense cones and a pair on each of the outer margins.

Cocoon.—The cocoons (Plate III, fig. 5) are formed very shortly after the larvæ enter the ground. Several times I have noticed that larvæ, which had fallen from the flower heads, had, on the following morning, formed their cocoons. The cocoons are rather regular and oval and formed of particles of earth joined together by a viscous substance which also lines the cocoon on the inside. They are very hard and retain their shape after the beetles have emerged, which is from 26 to 33 days after the cocoon is formed.

Pupa.—About eleven days after the larva has formed its cocoon transformation takes place and a creamy white pupa is formed

(Plate I, fig. 3). There are thirty-four strong setæ which support the pupa within its cocoon. Fourteen of these are on the dorsal side, three pairs along the middle, three setæ on each of the posterior angles, and one seta on each of the anterior angles of the prothorax. On the head there are two pairs of setæ; one pair on the middle of the head directly forward and a single smaller seta on each side of the head. The beak has two pairs of setæ; one pair near the middle and a pair near the base. In addition to these there are a pair of setæ on the outer angles of each pair of legs. The antennæ appear to be joined near the base of the beak but as a matter of fact are joined near the tip, as in the adult, the long basal segment in the pupa being inclosed in the pupal skin. The last ventral abdominal segment bears a pair of chitinized hooks. Length 2.89 mm. Width, 1.97 mm.

Adult.—The adult (technically described by Blatchley and Leng, 1916, p. 444) is a small beetle about three millimeters long, broadly ovate with a distinct white patch at the base of the elytra. The head, upper parts of the thorax, elytra and legs are dark, almost black, and coarsely punctured, while the under side of the thorax and abdomen are covered with whitish scales. The beak is long and has a pair of elbowed antennæ inserted on the lower half (Plate I, fig. 4).

The adults are not very active and are rarely seen. They are shy and like to hide at the base of the plant. When the plant is jarred they drop to the ground, feigning death, the beak and legs drawn close to the body. They often remain on their backs for several minutes without moving.

There is but one generation a year and the species hibernate as adults. All the larvæ, under observation, formed their pupal cases immediately on entering the ground and emerged in 26 to 33 days. After the first two weeks of July no eggs or larvæ could be found out of doors. The beetles seem to have disappeared. All the beetles which had been laying in captivity died off during the early part of July. In the fall the beetles were found very abundant among the pine needles at the base of pine trees. On November a large number were separated from the needles. Again on February 1 the beetles were obtained by sifting the same kind of material. Trash from the fields where the beetles were abundant during the summer

was examined without results. The beetles therefore leave the fields in fall and migrate to some sheltered place to pass the winter. The pine needles form a thick mat under the trees where *C. marginatus* was found very abundantly.

One cannot help but admire the way in which the transformations of this beetle have been so fitly adjusted to the development of the florescence of the dandelion. The early stages of the beetle and the formation of the flower are synchronous. In order to appreciate this it is necessary to recall the formation of the dandelion bud. It first appears as a minute shapeless bud hidden in a rosette of leaves below the surface of the ground. This bud soon pushes to the surface of the ground (Plate II, fig. 1) and becomes inviting to the beetles, for it is at this time that the adults lay their eggs in the buds. There is a comparatively short period of time in which the female must seek the bud and deposit her eggs. The eggs must be laid in the bud while it is still young. If they are not laid at this early stage the larvæ are unable to attain their full growth before the seeds ripen and become dried. Providing the eggs are laid at the proper time the larvæ attain their full growth by the time the seeds ripen and the characteristic white floats of the dandelion are formed. As the ripened seeds separate the larvæ crawl out and drop to the ground where they burrow into the soil for about an inch and form their cocoons.

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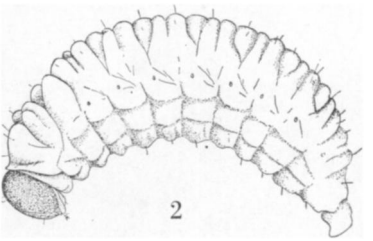
1



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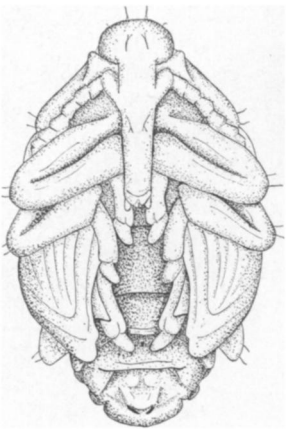

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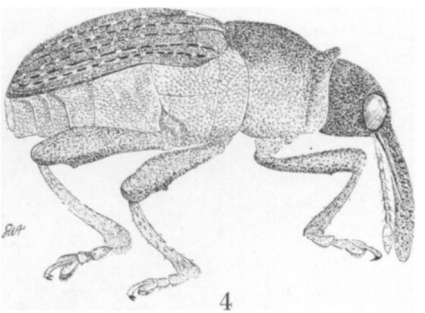

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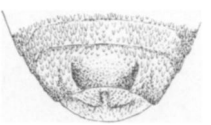

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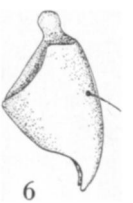

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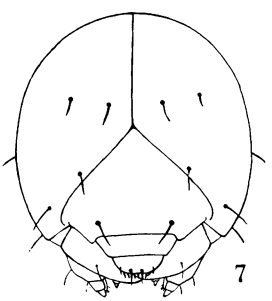

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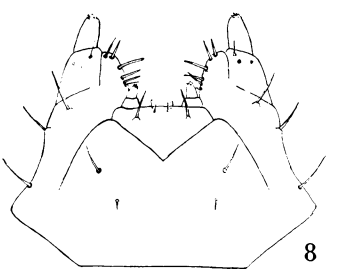
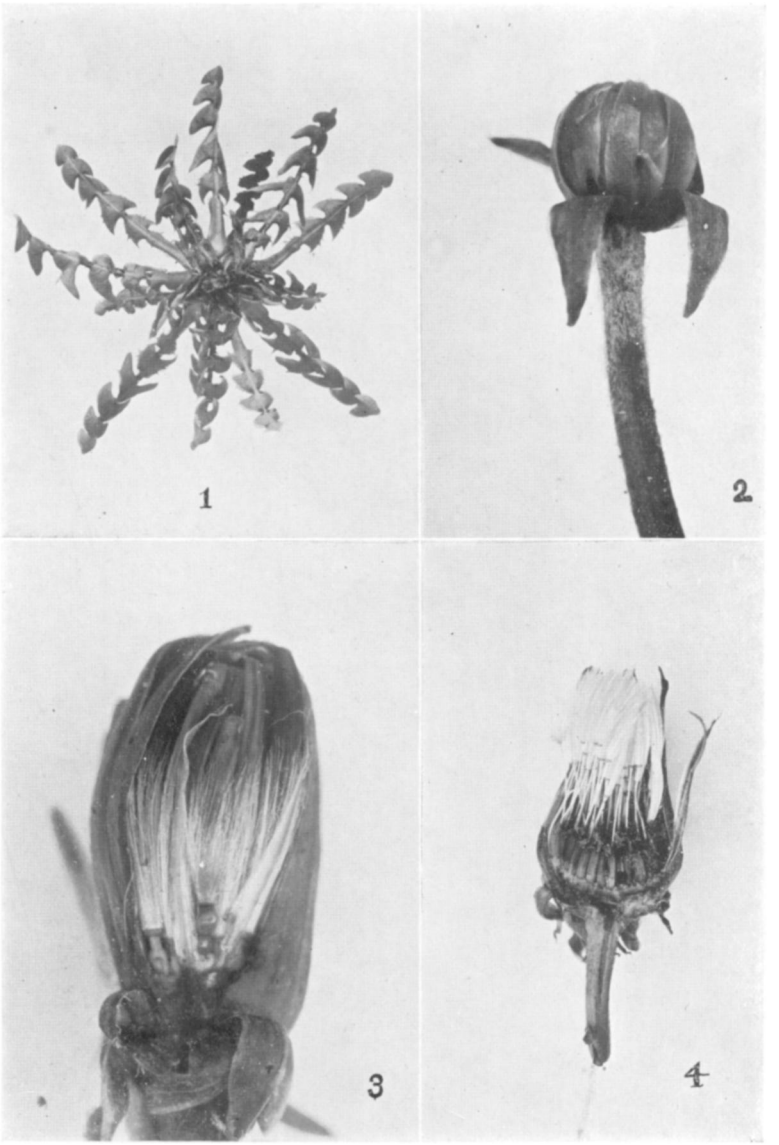
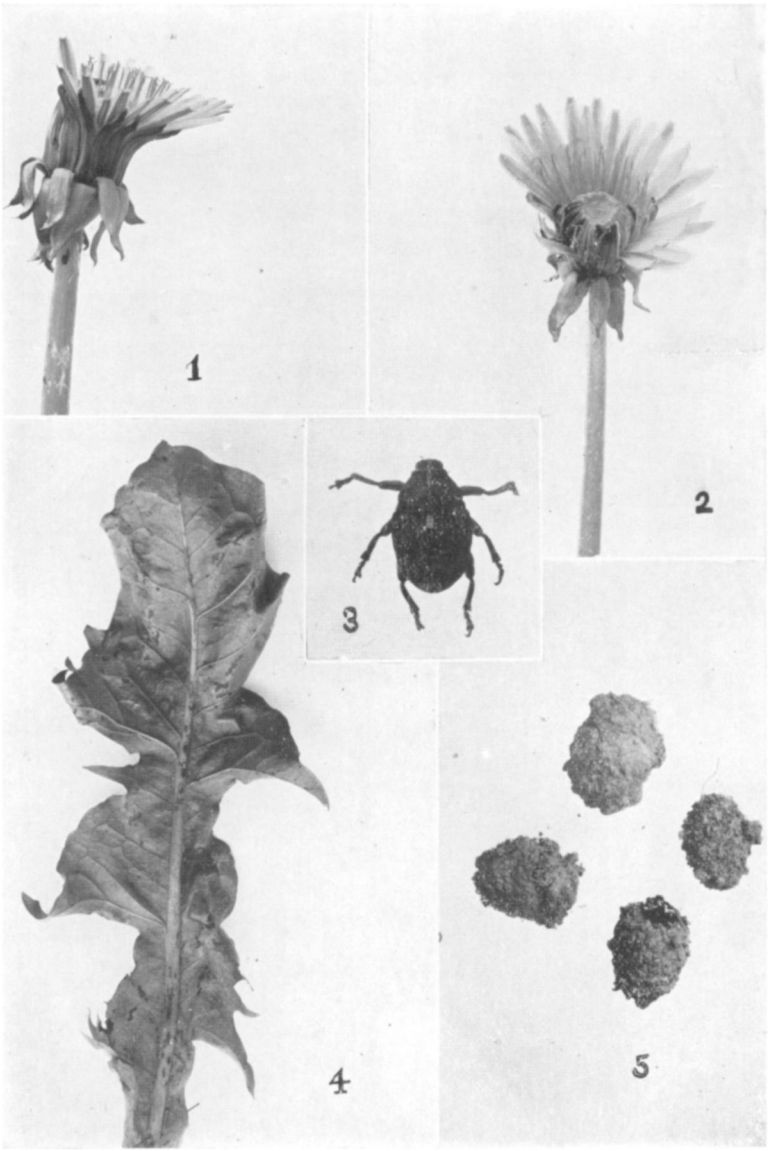


8

Ceutorhynchus marginatus Payk.



Ceutorhynchus marginatus Payk.



Ceutorhynchus marginatus Payk.

EXPLANATION OF PLATES.

PLATE 13.

Fig. 1. Eggs.
Fig. 2. Larva.
Fig. 3. Pupa.
Fig. 4. Adult.
Fig. 5. Pygidium of male.
Fig. 6. Mandible of larva.
Fig. 7. Head of larva.
Fig. 8. Labrum and maxillæ of larva.

PLATE 14.

Fig. 1. Dandelion rosette showing young buds at the time when the egg punctures are made.
Fig. 2. Dandelion bud showing egg puncture through the involucre; also blackened spots formed by the milky fluid of the dandelion which oozes through the egg punctures and hardens on the outside.
Fig. 3. Eggs in situ.
Fig. 4. Interior of flower head showing the work of the larva.

PLATE 15.

Fig. 1. Deformed dandelion flower (side view).
Fig. 2. Deformed dandelion flower (looking into the head).
Fig. 3. Adult.
Fig. 4. Work of adults on a dandelion leaf.
Fig. 5. Cocoons.

NOTES CONCERNING GASTROPHILUS HÆMORROIDALIS LINNÆUS (DIPT.)[1]

BY R. R. PARKER,

BOZEMAN, MONT.

While studying the bionomics of the Rocky Mountain spotted fever tick in the Powder River Valley in eastern Montana, during the season of 1916, the writer was able to make several incidental observations on certain pests of cattle and horses. The most interesting of these concerned the nose fly, or redtailed bot, *Gastrophilus*

[1] Contribution from the Laboratory of the Montana State Board of Entomology, Bozeman, Montana.